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PROXIMATE ANALYSIS AND MINERAL ELEMENT COMPOSITION OF FALSE YAM (*icacina trichantha)*TUBER AND OYSTER MUSHROOM (*pleurotus ostreatus)*

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ABSTRACT
False yam (*Icacina trichantha)* tubers and oyster mushroom (*Pleurotus ostreatus)* were analyzed for proximate composition and mineral composition. The analysis revealed that false yam contained a higher concentration of carbohydrate (91.93% against 49.15% of oyster mushroom) while oyster mushroom contained a higher concentration of protein (46.38% against 5.25% of false yam). Results obtained in this study also revealed that false yam contained a higher amount of magnesium (13.32%) and calcium (18.74%) while oyster mushroom contained a higher concentration of potassium (13.08%) and sodium (21.80%). Both plants had iron and zinc at tolerable level (1.00). This shows that false yam and mushroom have compositions that are similar to other edible root tubers and can be used as foods.

Keywords: False yam; Oyster mushroom; mineral, proximate, chemical composition

INTRODUCTION
False yam (*Icacina trichantha)* is a perennial shrub with erect blossoming shoots from a large underground fleshy tuber[1]. False yam has possible applications such as feed ingredient for livestock[2,3]. Current studies are employing the use of false yam starch as substitute for maize and cassava starches in industries. False yam is commonly called efik-isong in efik, Nigeria[14].

Oyster mushroom (*Pleurotus ostreatus)* grows in bracket-like clusters on decaying tree trunks. It is almost stemless. The fleshy, tender cap is 8 to 13 cm (3 to 5 in) across, tawny olive-coloured when young, but fades with age. The oyster mushroom is abundant from June to November. Several species of mushrooms have high medicinal values, for example, they show favourable effect in cancer, diabetes, hypertension and some infections[4].

MATERIALS AND METHOD

Collection and treatment of samples

The false yam and oyster mushroom samples used in this study were harvested from a farmland in the University of Uyo, Nigeria. The freshly harvested false yam tubers were washed, peeled, cut into tiny pieces and dried in the oven at 45^0C for 24 hours. The dried sample of false yam was pulverized using a blender mill. The powder of the sample (1g) was ashed in a furnace at 500^oC for 4 hours. On cooling,

the samples were leached with 3ml of Hydrochloric acid (HCl) and diluted to 20cm^3 with distilled water[5]. The same procedure was repeated for Oyster mushroom.

PROXIMATE ANALYSIS

Crude lipid, crude fibre and protein content the sample were analysed using A. O. A. C. (1984) method[6].

Determination of Crude Lipid: The sample (5g) was weighed into the thimble and dried in an oven at 102^{0}C for 5hours. On cooling, the thimble was inserted in a soxhlet extractor; 90ml of petroleum ether was used for the extraction. The extraction unit was assembled over a water bath. After extraction, the solvent was evaporated for recovery, the remaining contents was dried in the oven at 102^{0}C for 2 hours. On cooling, the flask and contents was weighed. This procedure was done for both false yam and mushroom samples. The crude lipid was then calculated using the formula below:

$$\text{Crude lipid (\%)} = (W2 - W1)\ X\ \frac{100}{S}$$

Where W1 = Weight of empty flask

W2 = Weight of flask and content

S = weight of sample

Determination of Crude fibre: The sample was weighed and transferred to a beaker followed by the addition of 200ml of 5HCl. The solution was heated in a water bath at 90^{0}C for 2hours, filtered and washed back into a beaker with 200ml of NaOH solution and reheated for 2 hours at the same temperature. The resulting mixture was filtered, washed thoroughly with hot water, alcohol and ether followed by drying at 120^{0}C. On cooling, the mixture was weighed, ignited in a muffle, cooled in a desiccator and weighed again. This procedure was carried out for both false yam and mushroom samples. The loss in weight was recorded as the crude fibre for both samples.

Determination of Protein: The sample was weighed into a standard 250lm flask containing 2g of copper sulphate, 2g of sodium sulphate and 5ml of sulphuric acid. The digestion flask was placed on the heating mantle and was heated at 50^{0}C for 2hours. On cooling, the solution was transferred to a 100mL standard flask and titrated against hydrochloric acid and standard sodium hydroxide (NaOH) solution using methyl orange dissolved in 25ml of 4% boric acid as indicator until a yellow colour was obtained. A blank titrated was also done in the same method. This procedure was done for both false yam and mushroom samples. The crude protein was calculated using the formula below:

$$Crude\ Protein\ (\%) = \frac{(Va - Vb\ X\ 1.4007)}{W\ X\ 100}\ X\ 6.25$$

Moisture content determination and dry matter

Moisture amount was determined by keeping weighed quantity of sample in a thermostat controlled oven at 80ºC for 2 hours[7]. The dry weight of each sample was taken on a weighing balance. The

percentage of the moisture content and dry mater was then calculated by the formula as presented below:

Moisture content (%) =

$$\frac{changeinweig\ \ ht\ (initial\ -finalweig\ \ ht)}{initialweig\ \ htbeforedrying} X\ 100$$

Dry Matter (%)= 100 – Moisture(%)

Total fat estimation

Crude fat was estimated by extracting the dry materials with diethyl ether solvent. The solvent was removed by using rotator evaporate.24The percentage of crude fat content was calculated by the following equation: Crude Fat(%)=Weight of ether extract/ weight of dried sample X 100

Determination of total ash

Total ash content was determined by igniting previously dried sample in a muffle furnace at 500°C for 4 hours[8].

The ash content was calculated by the equation below:

$$\text{Ash (\%)} = \frac{weig\ ht\ of\ \ ash}{weig\ ht\ of\ \ dried\ \ \ sample}\ X\ 100$$

Total carbohydrate estimation

Available carbohydrate content in the sample was determined following the method described by Ashraf, Ali, Ahmad, Ayyub, and Shafi (2013)[8]. This was calculated as the difference obtained after subtracting the lipid, ash and fibre values from the total dry matter using the formula below:

% Carbohydrate = 100 – (a + b + c + d)

Where a = amount of crude protein

b = amount of crude lipid

c = amount of ash content

d = amount of crude fibre

ELEMENTAL ANALYSIS OF MINERAL COMPOSITION OF THE SAMPLES

The presence of Sodium (Na), Potassium (K), Magnesium (M), Calcium (Ca), Phosphorus (P), Zinc (Zn) and Iron (Fe), Vitamin A, Vitamin C, were analysed in the samples using the A.O.A.C (1984) standard procedures[6].

DETERMINATION OF ANTI-NUTRIENT COMPOSITION OF THE SAMPLES

The tannins, oxalate, phytic acid and cyanide content in the samples were determined in the methanol extract of the samples using the method described by A. O. A. C (1948) and Burns (1971)[9].

RESULT DISCUSSION

The result for chemical analysis carried out on the false yam and oyster mushroom samples as presented in Table 1 reveal the moisture content to be 40% and 46%, crude lipid – 0.92% and 0.88%, carbohydrate – 91.93% and 49.15% in false yam and mushroom respectively.

Table 1: Chemical composition of False yam and Oyster mushroom

Proximate component (%)	False yam	Oyster mushroom	Mineral composition (mg/100g)	False yam	Oyster mushroom
Moisture	40.00	46.38	Fe	1.00	1.00
Crude lipid	0.92	0.88	Zn	0.48	0.26
Crude fibre	0.75	2.05	P	0.49	0.56
Protein	5.25	17.42	Mg	13.20	12.35
Ash	1.15	1.55	Ca	18.74	2.05
Carbohydrate	91.93	49.15	K	9.99	13.08
Fat (kcal)	40.00	39.00	Na	16.66	21.80

The amount of magnesium (Mg) was 13.20 and 12.35, zinc (Zn) – 0.48 and 0.26, sodium (Na) – 16.66 and 21.80 in false yam and mushroom respectively.

The high values of the moisture contents of the samples indicate that they are highly perishable. High moisture content support vulnerability to microbial growth and enzyme activity.[10,11]. The moisture content of oyster mushroom (46.36%) agrees with 46.95 percent reported by Afiukwa*et al.*(2013). Higher value of moisture content of oyster mushroom (88.90, 88.40 and 78.52)were presented by Khydagi*et al.*(1998);Zahid*et al.* (2010) and Arbaayah *et al.,* (2013) respectively in their studies of analysis of false yam and mushroom. Previous studies by Wong and Chye (2009) suggested that the removal of moisture content during processing may increase the concentration of nutrients in the mushroom thereby, extending shelf life. Moisture content of the false yam tuber (40.01%) is higher than 6.63% obtained from the unprocessed seed of false yam as reported by Golly *et al.* (2013). Amount of moisture in the false yam is higher than 32.00% reported by Umoh *et al.,* (2014).

The primary role of lipids in the body is to provide energy for muscles and body processes, regulate body temperature, aid proper digestion and absorption of food and nutrients. From the results, the lipid value for false yam (0.92) was higher than that of oyster mushroom (0.88). The amount of lipid for oyster mushroom obtained was higher than 0.46 reported by Zahid*et al.* (2010). Findings by Umoh *et al.,* (2014) yielded high lipid value of false yam to be 2.10%.

The fibre contents of false yam and mushroom are extremely low compared to the values of obtained by Afiukwa *et al.,* (2013). Fibre contents in the oyster mushroom (2.05%) is lower than 7.8% presented by Khydagi *et al.,* (1998) and higher than 0.63 reported by Zahid *et al.* (2010). Amount of

fibre in the false yam tuber (0.75) used in this study is relatively higher than 0.29 reported by Umoh *et al.* (2014) but lower than 1.42 contained in the seeds (Golly *et al.,* 2013).

The protein content of oyster mushroom (17.42%) was higher than that of false yam (5.25%). This shows that the mushroom posses an appreciable amounts of protein from nutritional perception, suggesting that *Pleurotus ostreatus* is a rich source of protein. The obtained values of protein in the oyster mushroom compare favourably with 16.35% reported by Afiukwa *et al.* (2013), but were lower than 30.9% presented by Khydagi *et al.* (1998). Although studies presented by Zahid *et al.* (2010) and showed lower value of protein (4.83); it still implies that *pleurotus ostreatus* are rich in protein. Amount of protein in the false yam tuber (5.25) is lower than 10.07 present in the seed (Golly *et al.,* 2013) but higher than 3.41 reported by Umoh *et al.* (2014).

Ash content for the oyster mushroom and the false yam were relatively low (1.55%, 1.15% respectively). Concentration of ash in oyster mushroom (1.15%) is lower than 10.6% reported by Khydagi *et al.* (1998). Other studies have also presented low values of ash in oyster mushroom (1.41% by Zahid *et al.,* 2010).The ash content of the false yam (1.15) compare favourably with 0.89 presented by Umoh *et al.* (2014).

The high values of carbohydrate indicate that both false yam and oyster mushrooms are good energy food sources. The carbohydrate concentration of the false yam (91.93) was higher than that of the oyster mushroom (49.15).This is an indication that the false yam is very rich in carbohydrate. The amounts of carbohydrate detected in the *Pleurotus ostreatus* (49.15%) compare well with the amount (44.4) obtained by Afiukwa *et al.* (2013) and 48.5% obtained by Khydagi *et al.* (1998). The false yam tuber used in this study contained high concentration of carbohydrate (91.93) compared to the low value (74.80) contained in the seed (Golly *et al.*, 2013). High value of carbohydrate in false yam (93.31) has also been discussed by Umoh *et al.* (2014).

The amount of fat in the false yam (40%) was similar to that of the oyster mushrooms (39%). The fat content of the both samples are higher than the amounts of protein. The fat content of (39%) is higher than (22.00%) obtained for *Pleurotus ostreatus* by Afiukwa *et al.* (2013) and 2.2% obtained by Khydagi *et al.* (1998). Studies presented by Zahid *et al.* (2010).has also shown high amounts of fat in oyster mushroom (41.80)

MINERAL COMPOSITION

The result from the table presents even important mineral elements (Ca, P, Fe, Na, K, Mg, Zn,) in the two plants samples. All the mineral elements were found in considerable quantity in both samples. Fe, Zn and P had the smallest amount of concentrations.

Calcium is higher in the false yam (18.74) than in the oyster mushroom (2.05). The concentration of calcium in large amounts in the false yam makes it an important food for formation and maintenance of bones and normal functioning of nerves and muscles in humans and other vertebrates.[12]The value of calcium detected in oyster mushroom (2.05) is extremely lower than 37.41 by Afiukwa *et al.* (2013). A lower value of calcium in oyster mushroom was also presented by Zahid *et al.* (2010) to be 0.19. The concentration of calcium in the seed of false yam (Golly *et al.,* 2013) is higher

(56.30) than 18.74 obtained in this study. Findings by Umoh *et al.* (2014) report a higher value of calcium (98.32) in false yam tuber compared to 18.74mg/100g obtained in this study.

Phosphorus is an important constituent of nucleic acids and essential for bone and tooth formation and for acid-base balance. The amounts of phosphorus detected in both samples were relatively low. The value of P for oyster mushroom (0.56) was lower to 122.28presented by Afiukwa *et al.* (2013) and 41.13 reported by Zahid *et al.* (2010) respectively. Amount of potassium in false yam obtained in this study (0.49) is extremely lower than 126.67 in the seed reported by Golly *et al.* (2013) but higher than 0.12mg/g reported by Umoh *et al.* (2014).

Sodium (Na) and potassium (K) are important in the maintenance of osmotic balance between cells and the interstitial fluid in animal systems. In the samples, Na and K in oyster mushroom (21.8, 13.08) is greater than (16.67, 9.99) in false yam respectively. This implies that oyster mushroom would be excellent in lowering blood pressure, reducing the risk of osteoporosis and in maintaining bone health (Yusuf *et al.*, 2007; Wani *et al.*, 2010).The value of K found in oyster mushroom (13.08) is lower than 122.28 and 35.17 reported by Afiukwa *et al.* (2013) and Zahid *et al.* (2010) respectively. The concentration of K in the false yam (9.99) is lower than 37.23 in the seed reported by Golly *et al.* (2013) and 31.51 reported by Umoh *et al.* (2014). Amount of sodium in false yam (16.66) obtained in this study is relatively lower compare well with 18.89 presented by Umoh *et al.* (2014).

Iron, which is essential for the biosynthesis of the oxygen-carrying pigment of red blood cells (haemoglobin) and the cytochromes that function in cellular respiration,[20] is present in equal amounts in the samples. The amounts of Fe found in the oyster mushroom (1.00 mg/100g) is within the range of value (1.15 mg/100g) reported by Afiukwa *et al.* (2013). Lower value of Fe was presented by Zahid *et al.* (2010).Amount of Fe present in the false yam (1.00) is lower than 3.89 present in the seed as reported by Golly *et al.* (2013) and 2.84 reported by Umoh *et al.* (2014).

Concentration of Mg and Zn, which are indispensable in numerous biochemical pathways as important co-factors for certain enzymes compared well in the samples. The concentration of Mg (12.35mg) in the oyster mushroom was similar to 13.60 detected by Afiukwa *et al.* (2013). Amount of Mg for oyster mushroom obtained in this study was smaller than 37.39 presented by Zahid *et al.* (2010). Amount of Mg and Zn contained in the false yam (13.32 and 0.48) is lower than the values (21.90 and 0.83) reported in the seed by Golly *et al.* (2013).Umoh *et al.* (2014) reported a higher value of zinc to be 1.90mg/g.

ANTI-NUTRIENT COMPOSITION

The anti nutrients investigated in this study were tannin, oxalate, cyanide and phylate. The study reveals cyanide to be 12.9 and 8.64, tannin- 1.00, oxalate- 0.48 and 0.26 in false yam and mushroom respectively.

Table 2: Vitamins and anti nutrients in False yam and Oyster mushroom

	False yam	Oyster mushroom	Anti-nutrient component	False yam	Oyster mushroom

			(mg/100g)		
Vitamin A (mg/100g)	2.00	0.23	Tannin	1.00	1.00
Vitamin C (mg/100g)	0.60	0.51	Oxalate	0.48	0.26
			Cyanide	12.9	8.64
			Phytic acid	1.74	1.99

Cyanide is a normal constituent of the blood but itis usually at low concentrations of less than 12µmol[13]. Cyanide is reported to be very toxic when exposed to even lower concentrations. HCN can precipitate dysfunction of the central nervous system, respiratory failure and cardiac arrest[14]. Symptoms of cyanide poisoning include headache, drowsiness, vertigo, weak and rapid pulse, deep and rapid breathing, nausea and vomiting. In this study, hydrogen cyanide content of the oyster mushroomand false yam was found to be 8.64mg/g and 12.96mg/g respectively.The value of cyanide in oyster mushroom (8.64mg/g)is significantly higher than 0.198 and 4.51mg/g reported by Alawuba *et al.*(2014) and Afiukwa *et al.* (2013).

Phytates are inositol hexaphosphoric acids which form complexes with salts of calcium, zinc, magnesium, iron and render them unavailable for absorption and utilization in the body.[15]Thephytates content of the false yam and oyster mushroom are seen as 1.74 and 1.99mg/100g. These values are over ten times lower than the safe limit (22.10mg/100g) (WHO, 2003). The results are also comparable to 1.17 reported by Ashraf *et al.*(2013). However, the concentration of phytate in false yam (1.74) is lower than 3.85mg/g reported by Umoh (2013).

Oxalate is an anti-nutritional factor mostly found in cocoyam, legumes and vegetables. Dietary oxalate has been known to complex with calcium, magnesium, and iron and inhibits their absorption by humans. Oxalates cause calcium deficiency both in man and in non-ruminants. The oxalate content of the oyster mushroom and false yam was found to be 0.26 and 0.48mg/g respectively. These values are lower than the tolerable limit given by WHO (105.00mg/100g). Oxalate content in the oyster mushroom compare well with 0.24 reported by Alawuba *et al.*(2014). High amount of oxalate in false yam tuber (98.25%) has been reported by Umoh (2013). This value is exceedinglyhigher than the 0.48 obtained in this study.

Tannins inhibit the digestibility of protein. Its concentration was low in the both samples (1.00mg/100g). This amount is lower to 3.85mg/g for false yam reported by Umoh (2013).

CONCLUSION

The study of the proximate and mineral element compositions of false yam and oyster mushroom reveals that the both plants would be very good in complementing nutrient supplement in food. False yam can be used as a source of starch. It is suggested that these plants be cultivated artificially to increase its availability across the nation for full exploitation.A further study is recommended to

investigate conditions that will reduce the values of anti-nutrient and moisture content in the Oyster mushroom and false yam to enable their use for industrial applications.

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